

# Ultrasonographic examinations: indications and preparation of the patient

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## Basic rules

- Although ultrasonography is safe and convenient to patients it should not be used without a clear clinical question that can be answered by the requested examination.
- Ultrasonography is not the primary investigation in the following clinical problems:
  - Dyspepsia
    - Gastroscopy should be preferred.
    - Gallstones eventually detected by ultrasonography in a dyspeptic patient are usually not the cause of the patient's symptoms.
  - Lower abdominal pain
  - The pelvic organs are often poorly visualized by transabdominal ultrasonography. Vaginal ultrasonography by a gynaecologist is recommended if pathology of the uterus or the ovaries is sought.
  - If the symptoms suggest pathology in the gastrointestinal tract endoscopy should be preferred.
- Globus sensations, symptoms of upper respiratory or oesophageal obstruction
  - Plain radiographs and endoscopy should be preferred.

- Ultrasonography is the primary investigation in the following clinical questions:
  - Presence of gallstones and/or acute cholecystitis in a patient with acute colicky upper abdominal pain with local tenderness or pathological liver function tests
  - Presence of hydronephrosis or a renal tumour
  - Suspected abdominal aortic aneurysm
  - Solitary thyroid nodule (to detect more nodules or to diagnose a cyst)
  - Suspected deep vein thrombosis (Level of Evidence=B; Evidence Summary available on the EBM Web site)
- Ultrasonography with well-defined, limited indications can be performed by non-radiologists with a special training to perform the investigation. Residual urine and fluid collections before puncture can be examined by any doctor with local training.

## **Abdominal ultrasonography**

### **Upper abdomen**

- Includes the liver, gallbladder, biliary tract, pancreas, spleen, kidneys, aorta and retroperitoneal space (for details see below).
- The patient should not eat for 6 hours and drink for 2 hours before the examination.

### **Ascites**

- A clinically suspected ascites can be confirmed in patients with, e.g. heart failure, cirrhosis of the liver, nephrotic syndrome or abdominal tumour who would probably benefit from the treatment of the condition.
- No preparations are needed.

### **Abdominal infections**

- Ultrasonography may be helpful in detecting acute infection or peritonitis when the indications for surgery are determined.
- When intra-abdominal abscess as a complication of abdominal surgery or appendicitis (Level of Evidence=B; Evidence Summary available on the EBM Web site) is suspected.
- Ultrasonography is NOT a routine examination in suspected acute appendicitis (although the sensitivity of a negative examination is not sufficient to exclude appendicitis an inflamed appendix can often be seen) (Level of Evidence=B; Evidence Summary available on the EBM Web site) is suspected.

### **Pancreas**

- Included in the upper abdominal examination
- Indications
  - Suspicion of moderate or severe pancreatitis

- Suspicion of a pancreatic pseudocyst
- Suspicion of pancreatic carcinoma
- Pancreatic ultrasonography is rather insensitive and has many sources of error.
- Preparations: See upper abdomen.

## Liver

- Included in the upper abdominal examination
- All liver diseases: hepatomegaly, cirrhosis, tumours and metastases, cysts and abscesses, biliary obstruction, abdominal trauma, jaundice.
- Preparations: See upper abdomen.

## Kidneys and adrenal glands

- Included in the upper abdominal examination
- Renal tumours, cysts, polycystic disease, hydronephrosis, trauma and urologically silent kidney
- Adrenal adenomas can often be diagnosed (but not excluded) by ultrasonography.
- Primary examination in children with urinary tract infection to exclude structural abnormalities
- No preparations are needed, except in the assessment of recurrent abdominal pain in children where the patient should not eat for 6 hours and drink for 2 hours before the examination.

## Spleen

- Included in the upper abdominal examination
- Splenomegaly, ruptured spleen in abdominal trauma
- Preparations: See upper abdomen.

## Gallbladder

- Included in the upper abdominal examination
- Primary examination in the diagnostics of gallstone disease and cholecystitis.
- Cancer of the gallbladder cannot be ruled out by ultrasonography.
- Preparations: See upper abdomen.

## Urinary bladder and prostate

- Urinary retention
- Residual urine after voiding (See Pictures 1, 2 of the corresponding full text guideline available on the EBM Web site) (See related EBM Guideline: **Determining the volume of residual urine by ultrasonography** available on the EBM Web site)
- Size of the prostate (See Pictures 3, 4 of the corresponding full text guideline available on the EBM Web site) prostatic nodules
- Preparations: the patient should have a full bladder during the examination.
- Transurethral ultrasonography of the prostate is a basic examination by urologists in the assessment of prostatic disease.

# Pelvic ultrasonography and ultrasonography during pregnancy

- See articles (See related EBM Guideline: **Gynaecologic ultrasound examination** available on the EBM Web site) (See related EBM Guideline: **Ultrasound scanning during pregnancy** available on the EBM Web site)

## Ultrasonography of blood vessels

### Aorta

- Aortic aneurysm and dissection
- Preparations: See upper abdomen (with the exception of emergencies).

### Vascular prostheses

- Surgical complications: haematoma, aneurysm or abscess
- Preparations: the patient should not eat for 6 hours and drink for 2 hours before the examination.

### Compression and doppler examination of the lower extremities

- Arterial obstruction and occlusion of the lower extremities (Level of Evidence=B; Evidence Summary available on the EBM Web site)
- Deep venous thrombosis of the femoral and popliteal veins (Level of Evidence=B; Evidence Summary available on the EBM Web site) (See related EBM Guideline: **Deep venous thrombosis** available on the EBM Web site). Ultrasonography is insensitive in the examination of calf veins (Level of Evidence=A; Evidence Summary available on the EBM Web site).
- The function of superficial veins can be assessed when planning surgery for varicose veins.
- No preparations are needed.

### Carotid arteries

- Carotid stenosis
- Follow-up after endarterectomy
- No preparations are needed.

## Thoracic ultrasonography

### Pleural and pericardial cavity

- Suspected pleural or pericardial effusion
- No preparations are needed.

- **Echocardiography** (by cardiologists) (See related EBM Guideline: **Echocardiography** available on the EBM Web site).

## **Thyroid and parathyroid ultrasonography**

- Primary examination of a thyroid nodule
- No preparations are needed.

## **Soft tissues and joints of the extremities**

- Assessment of the need of surgical treatment for muscle and tendon injuries (e.g. rotator cuff, achilles tendon, patellar tendon)
- Baker's cyst, bursal fluid, peritendinitis
- Diagnosis of synovitis
- Confirmation of the diagnosis of a ganglion
- A limp or hip pain in children (effusion of the hip joint).
- No preparations are needed.

## **Maxillary and frontal sinuses**

- See related EBM Guideline: **Diagnosis of sinusitis** available on the EBM Web site
- No preparations are needed.

## **Testis and epididymis**

- Enlarged or painful scrotum (differential diagnosis of testis torsion and epididymitis, varicocele, hydrocele, spermatocele, scrotal hernia, haematoma, or contusion)
- Suspicion of a testicular tumour
- Investigation of male infertility
- No preparations are needed.

## **Ultrasonographically guided biopsies and punctures**

- Evacuation of cysts, haematomas and abscesses
- Cytological and histological specimens of suspected tumours (e.g. breast, thyroid gland)

## **Ultrasonographic examinations by general practitioners and other non-specialists in radiology**

- Ultrasonography is a dynamic examination that must be interpreted during the examination. The interpretation cannot usually be reliably performed from printouts afterwards.
- A doctor performing ultrasonographic examinations should be trained by a specialist.
- Some ultrasonographic examinations are suitable to be performed by any doctors, and some

for non-radiologists with a special training.

- A positive finding is significant (be careful not to harm the patient with false positive findings): a negative finding in ultrasonography performed by an inexperienced examiner should not be used to rule out a treatable disease.

## **Any doctor can perform the following examinations after local training**

- Determination of the size and position of a fluid cavity before puncture (urinary bladder, pleural space, ascites, abscess)
- Determination of residual urine volume and size of the prostate (See related EBM Guideline: **Determining the volume of residual urine by ultrasonography** available on the EBM Web site) (See related EBM Guideline: **Benign prostatic hyperplasia** available on the EBM Web site).

## **A doctor with special training for ultrasonography can perform the following examinations**

- Search for gallstones and signs of acute cholecystitis (thickened gallbladder wall and/or halo) in a patient with upper abdominal pain
- Search for hydronephrosis or dilated urinary tract in patient with urinary symptoms
- Diagnose or exclude abdominal aortic aneurysm
- Detect ascites or intra-abdominal bleeding (e.g. in a patient with mild, blunt abdominal trauma that does not require referral on the basis of the history or clinical presentation)
- Estimate the size of the spleen (a length exceeding 10 cm can be considered abnormal)
- Differentiate between a fluid collection or abscess from other subcutaneous masses (confirmation by puncture can be performed after ultrasonography)
- Compression examination of popliteal and femoral veins for the detection of deep venous thrombosis (See related EBM Guideline: **Deep venous thrombosis** available on the EBM Web site)
- Some ultrasonographic examinations during pregnancy (See related EBM Guideline: **Ultrasound scanning during pregnancy** available on the EBM Web site).

## **Related evidence**

- Compared to the landmark technique for placement of internal jugular and subclavian central venous catheters, ultrasound guidance significantly increases the probability of success and the number of complications (Level of Evidence=A; Evidence Summary available on the EBM Web site)

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